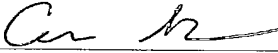


FORM PTO-1390 (Modified) (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER DN1999200USA
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 70/089259)
INTERNATIONAL APPLICATION NO. PCT/US99/22568	INTERNATIONAL FILING DATE September 30, 1999	PRIORITY DATE CLAIMED	
TITLE OF INVENTION LOCKED BEAD CONSTRUCTION			
APPLICANT(S) FOR DO/EO/US. KOEUNE, Jean-Marie Jules Joseph			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below. 4. <input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31). 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2)) <ol style="list-style-type: none"> a <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b <input type="checkbox"/> has been communicated by the International Bureau c <input checked="" type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> a <input type="checkbox"/> is attached hereto. b <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4) 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3)) <ol style="list-style-type: none"> a <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau) b <input checked="" type="checkbox"/> have been communicated by the International Bureau. c <input type="checkbox"/> have not been made, however, the time limit for making such amendments has NOT expired. d <input type="checkbox"/> have not been made and will not be made 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)) (<i>unexecuted</i>) 10. <input type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)) 11. <input checked="" type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409). 12. <input checked="" type="checkbox"/> A copy of the International Search Report (PCT/ISA/210) <p>Items 13 to 20 below concern document(s) or information included:</p> <ol style="list-style-type: none"> 13. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. 14. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included 15. <input checked="" type="checkbox"/> A FIRST preliminary amendment. 16. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 17. <input type="checkbox"/> A substitute specification. 18. <input type="checkbox"/> A change of power of attorney and/or address letter 19. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825. 20. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4). 21. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4) 22. <input checked="" type="checkbox"/> Certificate of Mailing by Express Mail 23. <input type="checkbox"/> Other items or information 			

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): Koeune		Docket No. 10/089259 <small>BN1999200USA</small>	
Serial No.	Filing Date concurrently herewith	Examiner	Group Art Unit
Invention: LOCKED BEAD CONSTRUCTION			
<p>I hereby certify that the following correspondence:</p> <div style="border: 1px solid black; padding: 10px; margin: 10px 0;"> TRANSMITTAL LETTER </div> <p style="text-align: center;"><i>(Identify type of correspondence)</i></p> <p>is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on</p> <p style="text-align: center;"><u>March 26, 2002</u> <i>(Date)</i></p> <div style="text-align: right; margin-top: 20px;"> <u>Catherine Senkfor</u> <i>(Typed or Printed Name of Person Mailing Correspondence)</i>  <i>(Signature of Person Mailing Correspondence)</i> <u>ET709528037US</u> <i>("Express Mail" Mailing Label Number)</i> </div>			
<p>Note: Each paper must have its own certificate of mailing.</p>			

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re : Application of Koeune
For : **LOCKED BEAD CONSTRUCTION**
Serial No. :
Filed : Concurrently herewith
Group Art Unit :
Examiner :
Our Docket No. : DN1999200USA

March 26, 2002

**ASSISTANT COMMISSIONER
OF PATENTS**

Box Patent Application
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

This is a preliminary amendment filed with a 35 U.S.C. 371 filing of a PCT International Application designating the United States.

Please amend the referenced application as follows:

IN THE CLAIMS

Please cancel claims 1-16 and replace with claims 17-32 as follows:

17. A pneumatic tire having a tread, a belt structure, a pair of sidewalls, a pair of bead regions, one or more plies anchored in each bead region, the pair of bead regions each including an inextensible annular bead core and an elastomeric element disposed adjacent to each bead core, characterized by:

the elastomeric element is disposed axially outwardly from the bead core relative to the equatorial plane of the tire; and

the carcass ply having a pair of turnup ends within the bead regions that extend radially outward from the carcass ply and under the bead cores relative to the equatorial plane of the tire, the turnup ends continue under an are turned up wrapping around the elastomeric elements, wrapping around the elastomeric elements with the locked end sections of the carcass ply located radially inward of the bead cores and anchored between the bead cores and the carcass plies.

18. The tire of claim 17 characterized in that the elastomeric elements are made of pre-cured

rubber.

19. The tire of claim 18 characterized in that the elastomeric elements are reinforced by fibers of materials including glass, Aramid, steel or polyester.

20. A method of forming a tire on a tire building drum, characterized by the steps of:
placing a carcass ply on the drum;
placing a pair of elastomeric toruses over the carcass ply for their incorporation in bead regions of the tire;

folding turnup ends of the carcass ply back over the elastomeric toruses so that anchored end sections are disposed against the turnup ends;

placing bead cores inward of and adjacent to the enfolded elastomeric toruses relative to the center of the building drum;

expanding the center section of the building drum to secure the bead cores in place; and
inflating the carcass to form the tire.

21. The process of claim 20 including the step of providing the tire building drum with grooves to receive the toruses.

22. The process of claim 20 where the center section of the building drum is expanded before the addition of chafer and other tire components on the drum.

23. A pneumatic tire comprising:
an axis and an equatorial plane;
a tread region, two bead regions, and two sidewalls;
a reinforcing ply and two bead cores;
wherein:
each sidewall extends generally radially between a respective one of the bead regions and the tread region;

each bead core is disposed in a respective one of the bead regions;

the reinforcing ply extends from one bead core, through a corresponding one of the sidewalls, through the tread region, through the other sidewall, to the other bead core;

the reinforcing ply has two turnup ends at opposite ends thereof, and the turnup ends wrap at least partially around a respective one of the bead cores;

further comprising two elastomeric elements;

wherein:

each elastomeric element is disposed in a respective one of the bead regions adjacent a respective one of the bead cores;

characterized in that:

the elastomeric element is disposed axially inward of the respective bead core.

24. The tire of claim 23, wherein:

the elastomeric elements are in the form of toruses, and each has a circular cross section.

25. The tire of claim 23, wherein:

the elastomeric elements are in the form of toruses, and each has a cross-section selected from the group consisting of square, oblong, triangular, octagonal.

26. The tire of claim 23 characterized in that:

the elastomeric elements are made of pre-cured rubber.

27. The tire of claim 23 characterized in that:

the elastomeric elements are reinforced by fibers of materials including glass, Aramid, steel or polyester.

28. The tire of claim 23, wherein:

each turnup end extends radially downwardly past the axially inward side of a respective one of the bead cores.

29. The tire of claim 28, wherein:

each turnup end extends axially outwardly under the bead core, then under a respective one elastomeric elements.

30. The tire of claim 29, wherein:

each turnup end wraps radially upward around the axially outward side of the elastomeric element.

31. The tire of claim 30, wherein:

each turnup end extends axially inwardly over the elastomeric element and radially downwardly by the axially inward side of the elastomeric element.

32. The tire of claim 31, wherein:

each turnup end extends axially inwardly under the bead core, between the bead and itself.

REMARKS

The claims have been amended to delete the numbers identifying elements, which were originally incorporated to comply with PCT practice.

Favorable examination and consideration are respectfully requested.

Respectfully submitted,



Howard M. Cohn

Registration No. 25,808

c/o Bruce Hendricks Dept. 823
The Goodyear Tire & Rubber Company
1144 East Market Street
Akron, Ohio 44316-0001
Voice (216) 752-0955
Fax (216) 752-0957

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10 Revisions 27 MAR 2002

PNEUMATIC TYRE HAVING LOCKED BEADS

5 TECHNICAL FIELD

The present invention relates to a pneumatic tire, specifically to the carcass ply turnup structure in the bead region and more specifically to a locked bead type of construction.

BACKGROUND OF THE INVENTION

10 In conventional tire construction, the carcass ply or plies are turned up around the bead cores and then extended radially outward in the sidewalls towards the tread in order to withstand the tensile stresses encountered during the use of the tire. As these stresses act in opposite direction on the carcass ply or plies proper and their upward turned portions, they cause shearing in the intermediate rubber.

15 Furthermore, the flexing of the sidewalls during travel subjects the carcass reinforcement and the upward-turned portions thereof to alternate stresses, in opposite directions, which causing additional shear stresses in this same zone. All of these stresses may lead to the rupture of the intermediate rubber and premature destruction of the tire.

To avoid these drawbacks, tire designers have extended the upward turned
20 portions of the carcass plies into zones of lesser shear, that is to say a greater distance radially outward in the sidewalls; however, in such cases the rigidity of the sidewalls is increased; ruptures of the upward turned portions of the plies may take place by compression in the sidewalls and in any event the road behavior of the tire is greatly modified.

25 The desirability of minimizing or eliminating the extension of the turnup portions of the carcass ply (or plies) radially outwardly of the bead core is the premise on which prior art locked-beads designs were developed. The proposed advantages included improved bead durability, and reduced material costs. Furthermore, the locked-bead approach allows the sidewalls to have a reduced thickness in the vicinity of the bead
30 region. This reduced sidewall thickness results in a better distribution of flexibility that is particularly advantageous with tires having a small height to width ratio (for example of the order of 0.6).

However, locked-bead tire designs require a careful consideration of how best to anchor the carcass plies in the bead region without an excessive concentration of stress at

Art. 34

2

the carcass ply ends.

One approach is to clamp the carcass plies to the bead core. For example, U.S. Pat. No. 4,922,985, ('985) discloses a carcass ply having a main portion that extends between both bead cores of the tire and turnup portions that are anchored around each bead core by a clamping member. According to '985, the clamping member comprises a strip of side-by-side cords of a heat shrinkable material embedded in a suitable elastomeric substance having a permanent thermal shrinkage of at least 2 percent.

Another approach, as disclosed by U.S. Patent 4,185,676, ('676) is to extend the portions of the carcass reinforcement that have been turned upward around the bead rings toward the outside of the tire and embed them in an annular portion of the tire that protrudes from the outer lower portion of the corresponding sidewall. According to '676, a mechanical de-coupling is obtained between the elastic matrices surrounding the carcass reinforcement and its upward turned portions, thus eliminating shearing in these zones.

Another approach, as disclosed by WO95/23073 is, in each bead region of the tire, to wrap a turnup end of the carcass reinforcing ply around a wedge-shaped rubber section which is disposed adjacent and axially (or laterally) inward (towards the equatorial plane) of the bead.

It is continually the goal in the art to simplify the construction and reduce the expense of building locked-bead type tires, yet improve the durability, handling, rolling resistance and other properties of the tires.

OBJECTS OF THE INVENTION

It is an aspect of the present invention to provide a more efficient tire bead manufacturing process as defined in one or more of the appended claims and as such, having the capability of accomplishing one or more of the following subsidiary objects.

An aspect of the present invention is to improve bead durability by eliminating stresses at ply ending.

Another aspect of the present invention is to minimize the shear stresses at the chafer/ply interface in the bead area by eliminating the ply turn-up around the bead.

Yet another aspect of the present invention is to maximize sidewall flexibility in the vicinity of the rim flange to increase the tire load capacity and improve rim-bead seating.

Other aspects and advantages of this invention will become readily apparent as the

2A

invention is better understood by reference to the accompanying drawings and the detailed description that follows.

SUMMARY OF THE INVENTION

The present invention relates to a pneumatic tire, specifically to the carcass ply turnup structure in the bead region and more specifically to a locked bead type of

construction.

The preferred embodiment of the present invention is a pneumatic tire having a tread, a belt structure, and a carcass structure comprising a pair of sidewalls, a pair of bead regions, and one or more plies of cord reinforced elastomeric material anchored in each bead region and extending radially outward through the sidewalls and laterally across a crown portion of the tire radially inward of tread.

The bead regions of the present invention each comprise an inextensible annular bead core in a side-by-side relationship with a coaxial elastomeric torus, the torus placed outwardly adjacent to each bead core relative to the equatorial plane of the tire. The carcass plies within each bead region extend radially inward from the sidewalls and proceed inward of the bead core relative to the equatorial plane of the tire. The carcass plies are then wrapping around and radially outward of the elastomeric torus with the locked edge of the carcass plies located back under and radially inward of the bead core.

The elastomeric torus can be made of pre-cured rubber or reinforced by fibers, including by way of example and not by way of limitation, materials such as glass Aramid, steel, or polyester.

A method of forming a tire according to the present invention using a tire building drum of substantially conventional design upon which the carcass plies, the bead core and the elastomeric torus are assembled. The method includes the steps of; placing the pair of elastomeric toruses over the carcass material for their incorporation in the bead regions of the tire; folding the margins of the carcass material over the top of the elastomeric toruses; placing a bead core inwardly adjacent to the enfolded elastomeric torus relative to the center of the drum; and expanding the drum to hold the bead cores in place, inflating the carcass and completing the tire by conventional tire building processes.

The tire forming drum can be provided with a groove to hold the torus. Also the center of the drum may be expanded after the application of the bead core and before the addition of the chafer and other components to prevent bead deformation.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will be made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. The drawings are intended to be illustrative, not limiting.

Certain elements in selected ones of the drawings may be illustrated not-to-scale, for illustrative clarity.

Often, similar elements throughout the drawings may be referred to by similar references numerals. For example, the element 199 in a figure (or embodiment) may be similar in many respects to the element 299 in an other figure (or embodiment). Such a relationship, if any, between similar elements in different figures or embodiments will become apparent throughout the specification, including, if applicable, in the claims and abstract.

In some cases, similar elements may be referred to with similar numbers in a single drawing. For example, a plurality of elements 199 may be referred to as 199a, 199b, 199c, etc.

The cross-sectional views presented herein may be in the form of "slices", or "near-sighted" cross-sectional views, omitting certain background lines which would otherwise be visible in a true cross-sectional view, for illustrative clarity.

The structure, operation, and advantages of the present preferred embodiment of the invention will become further apparent upon consideration of the following description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is the cross-sectional view of a prior art tire with a conventional locked-bead construction;

FIGURE 2 is a cross-sectional view of an embodiment of the present invention incorporating and new generation of locked-bead construction;

FIGURE 3 is a partial view of the bead region of a tire of the present invention.

FIGURE 4A is a partial view of the present invention on a tire forming drum during an initial step of the manufacturing process;

FIGURE 4B is a partial view of the present invention on tire forming drum during an intermediate step of the manufacturing process; and

FIGURE 4C is a partial view of the present invention on a tire building drum during a final step of the manufacturing process.

DEFINITIONS

"Apex" means an elastomeric filler located radially above the bead core and between the plies and the turnup plies.

"Aspect Ratio" means the ratio of the section height of a tire to its section width; also refers to the cross-sectional profile of the tire; a low-profile tire, for example, has a low aspect ratio.

"Axial" and "Axially" means the lines or directions that are parallel to the axis of

rotation of the tire.

"Bead" or "Bead Core" generally means that part of the tire comprising an annular tensile member of radially inner beads that are associated with holding the tire to the rim; the beads being wrapped by ply cords and shaped, with or without other reinforcement elements such as flippers, chippers, apexes or fillers, toe guards and chafers.

"Belt Structure" or "Reinforcement Belts" or "Belt Package" means at least two annular layers or plies of parallel cords, woven or unwoven, underlying the tread, unanchored to the bead, and having both left and right cord angles in the range from 18 degrees to 30 degrees relative to the equatorial plane of the tire.

"Breakers" or "Tire Breakers" means the same as belt or belt structure or reinforcement belts.

"Carcass" means the tire structure apart from the belt structure, tread, undertread over the plies, but including the beads.

"Casing" means the carcass, belt structure, beads, sidewalls and all other components of the tire excepting the tread and undertread.

"Circumferential" most often means circular lines or directions extending along the perimeter of the surface of the annular tread perpendicular to the axial direction; it can also refer to the direction of the sets of adjacent circular curves whose radii define the axial curvature of the tread, as viewed in cross section.

"Cord" means one of the reinforcement strands, including fibers, with which the plies and belts are reinforced.

"Crown" or "Tire Crown" means the tread, tread shoulders and the immediately adjacent portions of the sidewalls.

"Equatorial Plane" means the plane perpendicular to the tire's axis of rotation and passing through the center of its tread; or the plane containing the circumferential centerline of the tread.

"Footprint" means the contact patch or area of contact of the tire tread with a flat surface.

"Inner Liner" means the layer or layers of elastomer or other material that form the inside surface of a tubeless tire and that contain the inflating fluid within the tire.

"Insert" means the crescent-shaped or wedge-shaped reinforcement typically used to reinforce the sidewalls of runflat-type tires.

"Lateral" means a direction parallel to the axial direction.

"Ply" means a cord-reinforced layer of rubber coated radially deployed or otherwise parallel cords.

"Radial" and "radially" mean directions radially toward or away from the axis of rotation of the tire.

5 "Radial Ply Structure" means the one or more carcass plies or which at least one ply has reinforcing cords oriented at an angle of between 65 degrees and 90 degrees with respect to the equatorial plane of the tire.

"Radial Ply Tire" means a belted or circumferentially-restricted pneumatic tire in which at least one ply has cords which extend from bead to bead are laid at cord angles
10 between 65 degrees and 90 degrees with respect to the equatorial plane of the tire.

"Section Height" means the radial distance from the nominal rim diameter to the outer diameter of the tire at its equatorial plane.

"Section Width" means the maximum linear distance parallel to the axis of the tire and between the exterior of its sidewalls when and after it has been inflated at normal
15 pressure for 24 hours, but unloaded, excluding elevations of the sidewalls due to labeling, decoration or protective bands.

"Shoulder" means the upper portion of sidewall just below the tread edge.

"Sidewall" means that portion of a tire between the tread and the bead.

"Tangential" and "Tangentially" refer to segments of circular curves that intersect
20 at a point through which can be drawn a single line that is mutually tangential to both circular segments.

"Tread Cap" refers to the tread and the underlying material into which the tread pattern is molded.

"Tread width" means the arc length of the tread surface in the plane includes the
25 axis of rotation of the tire.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Prior Art Embodiment

Referring to **FIGURE 1** there is shown a prior art locked bead tire **110**. The prior art tire **110** has an annular tread **112** disposed radially outward of annular belt structure
30 **114**. Radially inward of the belt structure **114**, is a carcass structure **120** comprising one or more carcass plies **122** extending laterally between bead cores **124a,124b**. The turnup ends **122a,122b** of the carcass ply are turned up around the bead cores **124a,124b** and anchored to the beads by clamping members **126a,126b**. The clamping members

invention. The tire **230** is provided with an annular tread **232** and a belt structure **234** located radially inward of the tread. The tire **230** has a carcass structure **240** comprising two sidewalls, **236a,236b** and two bead regions **238a,238b** with at least one carcass ply **242** having turnup ends **242a,242b** anchored in bead region **238a,238b**, as discussed in more detail below. The turnup ends extend radially outward through sidewall **236a,236b**, proceeding laterally and radially inward of the belt structure **234**, returning radially inward through sidewalls **236a,236b** and anchored in bead region **238a,238b**.

The bead regions **238a,238b** comprise an inextensible bead core **244a** and **244b**, respectively, and an elastomeric torus or ring **246a** and **246b**, respectively. Each elastomeric torus **246a,246b** is located laterally outward from and adjacent to the bead cores **244a,244b**, respectively, relative to the equatorial plane **EP** of the tire **230**. The elastomeric torus **246a,246b** is preferably constructed of a pre-cured or partially cured rubber so that the torus can be easily handled and will maintain its shape during the initial manufacturing stages. The toruses **246a,246b** can be reinforced by fibers of materials including glass, aramid, steel and polyester. Preferred section diameter of torus **246a,246b** is 5mm to 8 mm which is compatible with the carcass ply flexibility. While the toruses are shown with a circular cross section, it is within the scope of the invention to provide a torus with other geometrical cross sections, such as but not limited to square, oblong, triangular and octagonal.

Referring to **FIGURE 3**, a detail the bead region **238b** of the tire **230** mounted on a tire rim **358** is illustrated. Bead region **238a** is a mirror image of bead region **238b** and therefore not discussed. As shown in **FIGURE 3**, ply **242** extends down sidewall **236b** and includes a turnup end **242b** that initially wraps around and under bead core **244b**. Turnup end **242b** then extends laterally outward under the bead core **244b** relative to the equatorial plane of the tire **230**, under the elastomeric torus **246b** and is then turned up and around the elastomeric torus **246b**. Continuing, the turnup end **242b** is folded back under the bead core **244b** so that the locked end section **250b** of the carcass ply turnup end **242b** is located radially inward of the bead core **244b** and anchored between the bead core and the initial turn of the carcass ply end **242b** where it extends laterally outward from the central portion of ply **242** and around and under the bead core **244b**. Note that the locked end sections **250a,250b** can wrap around the bead cores **244a,244b** and extend upward adjacent against the central portion of the ply **242**.

Dynamic Operation of the Preferred Embodiment Relative to the Prior Art

The preferred embodiment of the present invention provides all the benefits of conventional locked bead construction, as shown in **FIGURE 1**, including improved sidewall flexibility and the minimization of bending induced shear stresses where turned up portions of the carcass ply are placed adjacent to main portions of the carcass ply. In typical tire construction, as shown in **FIGURE 1**, due to the compression effect when the tire is deflected, harmful shear stress often occur where the turned up ends **122a,122b** of the carcass structure **120** extends radially outward of the bead cores **124a,124b**, respectively, as the load on the tire **110** tends to pull the main portion of the carcass ply **122** radially outward while the turned up end portions **122a,122b** of the carcass **122** is pulled radially inward. These stresses are concentrated in the turned up ends **122a,122b** of the carcass structure **120** which are constrained by the surrounding elastomeric material and with the assistance of clamping members **126a,126b** as described herein for prior art locked bead tires.

The present invention addresses this issue by providing locked end sections **250a,250b** of the turnup ends **242a,242b** of the carcass ply **242** radially inward of the bead cores **244a,244b**, respectively, so that they are constrained between the bead cores **244a,244b** and the turnup ends **242a,242b** and the main portion of the carcass ply **242**. This implies that the carcass ply **242** remains on tension when the tire is inflated or inflated and loaded. In addition, the elastomeric torus **246a,246b** performs a stress relief function that prevents concentrations of stress in the carcass ply **242**. Stresses in the cords of the carcass ply will cause the elastomeric torus **246a,246b** to deform reducing the stress on the carcass ply cords and facilitating the distribution of stress between adjacent ply cords. In comparison, locked bead designs where the carcass ply is anchored directly to an inextensible bead core will see higher concentrations of stress at the interface between the ply cords and the bead core.

Method of Manufacture

In accordance with the present invention the carcass ply **242** is securely anchored in the bead regions **238a,238b** of the tire **230** without requiring the extension of a turned up ends **242a,242b** of the carcass ply to extend radially outward beyond the bead cores **238a,238b**. This is accomplished by first turning the ends **242a,242b** of the carcass ply **242** up around the elastomeric torus **246a,246b**, respectively with anchored end sections **250a,250b** disposed against the ends **242a,242b** of the ply **242**. The bead cores

244a,244b are then placed on the outer facing surface of anchored end sections **250a,250b** and inwardly adjacent to the now enfolded elastomeric torus **246a,246b** relative to the equatorial plane of the tire **230** thereby securing the anchored end sections **250a,250b** of the ply **242** radially inward of the bead cores **244a,244b**.

Referring to **FIGURES 4A, 4B and 4C**, several steps in the process of forming the bead regions **238a, 238b** using a substantially conventional tire building drum are illustrated. Only the formation of bead region **238b** is described, since both regions are formed in the same manner. **FIGURE 4A** illustrates the initial step in process of building the tire **230** according to the present invention wherein the carcass ply **242** is placed on the tire building drum **452** followed by the addition of the elastomeric torus **246b** above a groove **454b** formed in a section **452b**. At rest, the inside diameter of the elastomeric torus **246b** should preferably be slightly smaller than the diameter of the drum **452** at the bottom of the groove **454b** during the initial building step. The elastomeric torus **246b** may be held in place within groove **454b** in section **452b** of the drum by pressing the elastomeric torus into groove **454b** by any conventional means. As illustrated by **FIGURE 4B**, the turnup end **242b** of the carcass ply **242** is then folded back over the elastomeric torus **246b** toward the center section **452c** of the drum **452** and the bead core **244b** is placed upon the locked or anchored end section **250b** inwardly of and adjacent to the now enfolded torus **246b** relative to the center portion **452c** of building drum **452**. Referring to **FIGURE 4C**, the center portion **452c** of the drum **452** is expanded prior to the addition of the chafer **248b** to prevent movement of the bead core **244b** when the carcass **242** is inflated and the manufacture of the tire **230** is completed by conventional tire building processes well known to those familiar with the art.

While the invention has been described in combination with embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing teachings. Accordingly, the invention is intended to embrace all such alternatives, modifications and variations as fall within the spirit and scope of the appended claims.

11

What is claimed:

1. A pneumatic tire (230) having a tread (232), a belt structure (234), a pair of sidewalls (236a,236b), a pair of bead regions (238a,238b), one or more plies (242) anchored in each bead region (238a,238b), the pair of bead regions (238a,238b) each including an inextensible annular bead core (244a,244b) and an elastomeric element (246a,246b) disposed adjacent to each bead core (244a,244b), characterized by:

the elastomeric element is disposed axially outwardly from the bead core relative to the equatorial plane of the tire (230); and

10 the carcass ply (242) having a pair of turnup ends (242a,242b) within the bead regions (238a,238b) that extend radially outward from the carcass ply (242) and under the bead cores (244a,244b) relative to the equatorial plane of the tire (230), the turnup ends continue under an are turned up wrapping around the elastomeric elements (246a,246b), wrapping around the elastomeric elements (246a,246b) with the locked end sections (250a,250b) of the carcass ply (242) located radially inward of the bead cores (244a,244b) and anchored between the bead cores (244a,244b) and the carcass plies (242).

2. The tire (230) of claim 1 characterized in that the elastomeric elements (246a,246b) are made of pre-cured rubber.

3. The tire (230) of claim 2 characterized in that the elastomeric elements (246a,246b) are reinforced by fibers of materials including glass, Aramid, steel or polyester.

4. A method of forming a tire (230) on a tire building drum (452), characterized by the steps of:

placing a carcass ply (242) on the drum (452);

25 placing a pair of elastomeric toruses (246a,246b) over the carcass ply for their incorporation in bead regions (238a,238b) of the tire;

folding turnup ends (242a,242b) of the carcass ply (242) back over the elastomeric toruses (246a,246b) so that anchored end sections (250a,250b) are disposed against the turnup ends (242a,242b);

30 placing bead cores (244a,244b) inward of and adjacent to the enfolded elastomeric toruses (246a,246b) relative to the center of the building drum (452);

expanding the center section (452c) of the building drum (452) to secure the bead cores (244a,244b) in place; and

inflating the carcass to form the tire.

12

5. The process of claim 4 including the step of providing the tire building drum (452) with grooves (454a,454b) to receive the toruses (246a,246b).

6. The process of claim 4 where the center section (452c) of the building drum (452) is expanded before the addition of chafer and other tire components on the drum.

7. A pneumatic tire (230) comprising:

an axis and an equatorial plane;

a tread region (232), two bead regions (238a, 238b), and two sidewalls (236a, 236b);

a reinforcing ply (242) and two bead cores (244a, 244b);

wherein:

each sidewall extends generally radially between a respective one of the bead regions and the tread region;

each bead core is disposed in a respective one of the bead regions;

the reinforcing ply extends from one bead core, through a corresponding one of the sidewalls, through the tread region, through the other sidewall, to the other bead core;

the reinforcing ply has two turnup ends (242a, 242b) at opposite ends thereof, and the turnup ends wrap at least partially around a respective one of the bead cores;

further comprising two elastomeric elements (246a, 246b);

wherein:

each elastomeric element is disposed in a respective one of the bead regions adjacent a respective one of the bead cores;

characterized in that:

the elastomeric element is disposed axially inward of the respective bead core.

8. The tire of claim 7, wherein:

the elastomeric elements are in the form of toruses, and each has a circular cross

section.

9. The tire of claim 7, wherein:

the elastomeric elements are in the form of toruses, and each has a cross-section selected from the group consisting of square, oblong, triangular, octagonal.

10. The tire of claim 7 characterized in that:

the elastomeric elements are made of pre-cured rubber.

11. The tire of claim 7 characterized in that:

the elastomeric elements are reinforced by fibers of materials including glass, Aramid, steel or polyester.

12. The tire of claim 7, wherein:

13

each turnup end extends radially downwardly past the axially inward side of a respective one of the bead cores.

13. The tire of claim 12, wherein:

each turnup end extends axially outwardly under the bead core, then under a
5 respective one elastomeric elements.

14. The tire of claim 13, wherein:

each turnup end wraps radially upward around the axially outward side of the elastomeric element.

15. The tire of claim 14, wherein:

each turnup end extends axially inwardly over the elastomeric element and radially
10 downwardly by the axially inward side of the elastomeric element.

16. The tire of claim 15, wherein:

each turnup end extends axially inwardly under the bead core, between the bead and
itself.

15

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(71) Applicant (for all designated States except US): **THE GOODYEAR TIRE & RUBBER COMPANY [US/US];**
1144 East Market Street, Akron, OH 44316-0001 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **KOEUNE, Jean-Marie, Jules, Joseph [BE/BE];** Foy, 7, B-6600 Bastogne (BE).

(74) Agent: **COHN, Howard, M.;** Robert W. Brown Dept. 823, The Goodyear Tire & Rubber Company, 1144 East Market Street, Akron, OH 44309-3531 (US).

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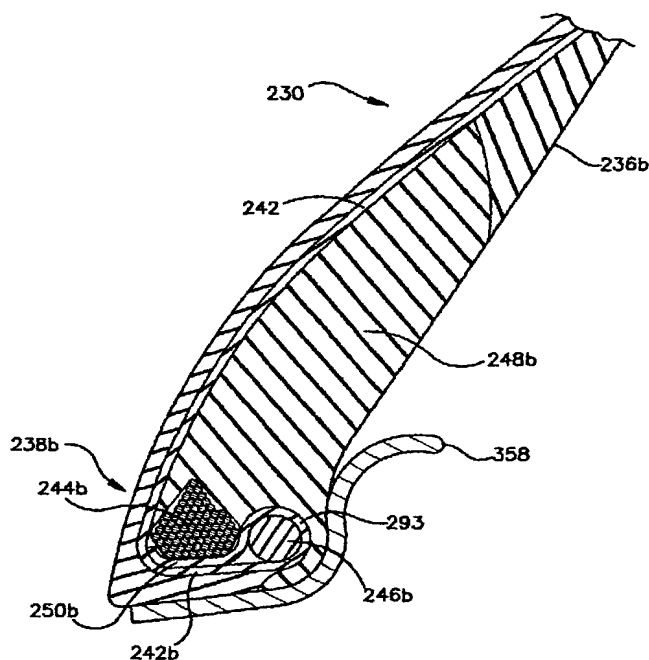
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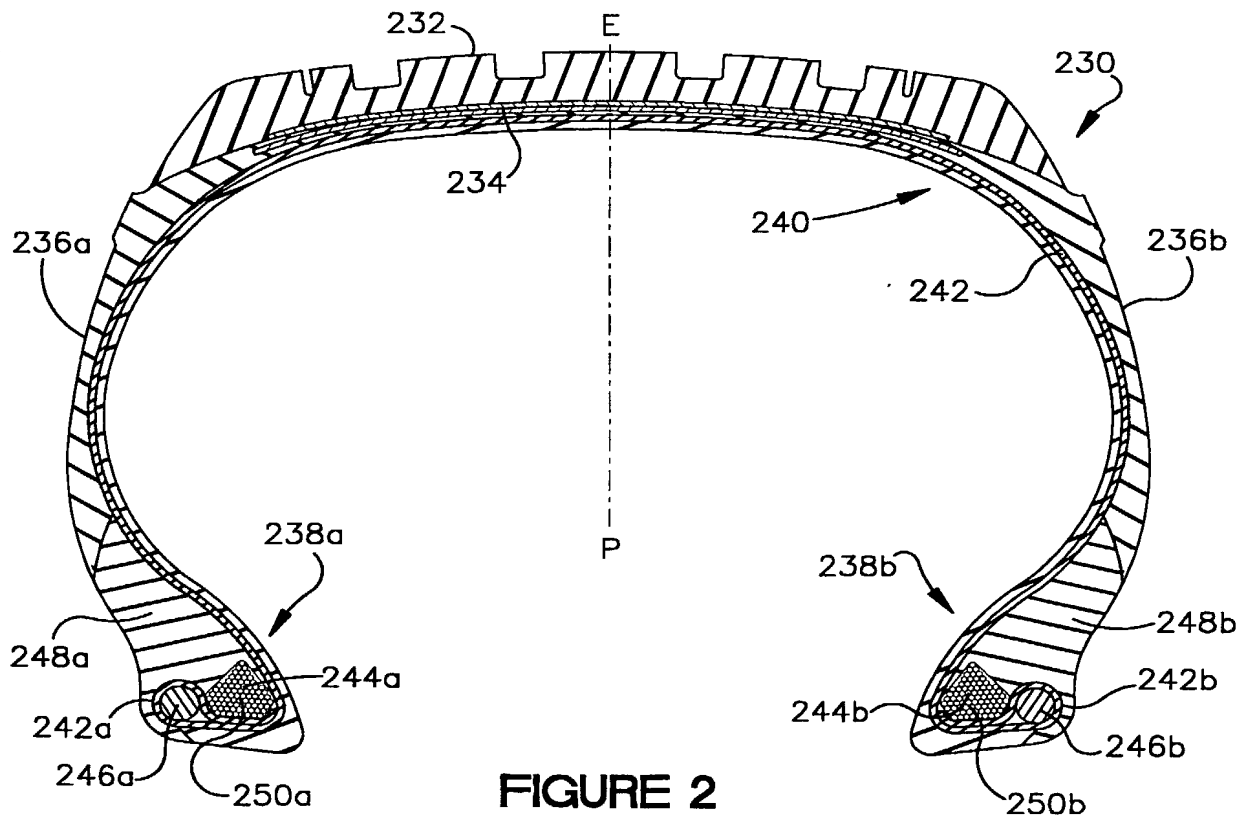
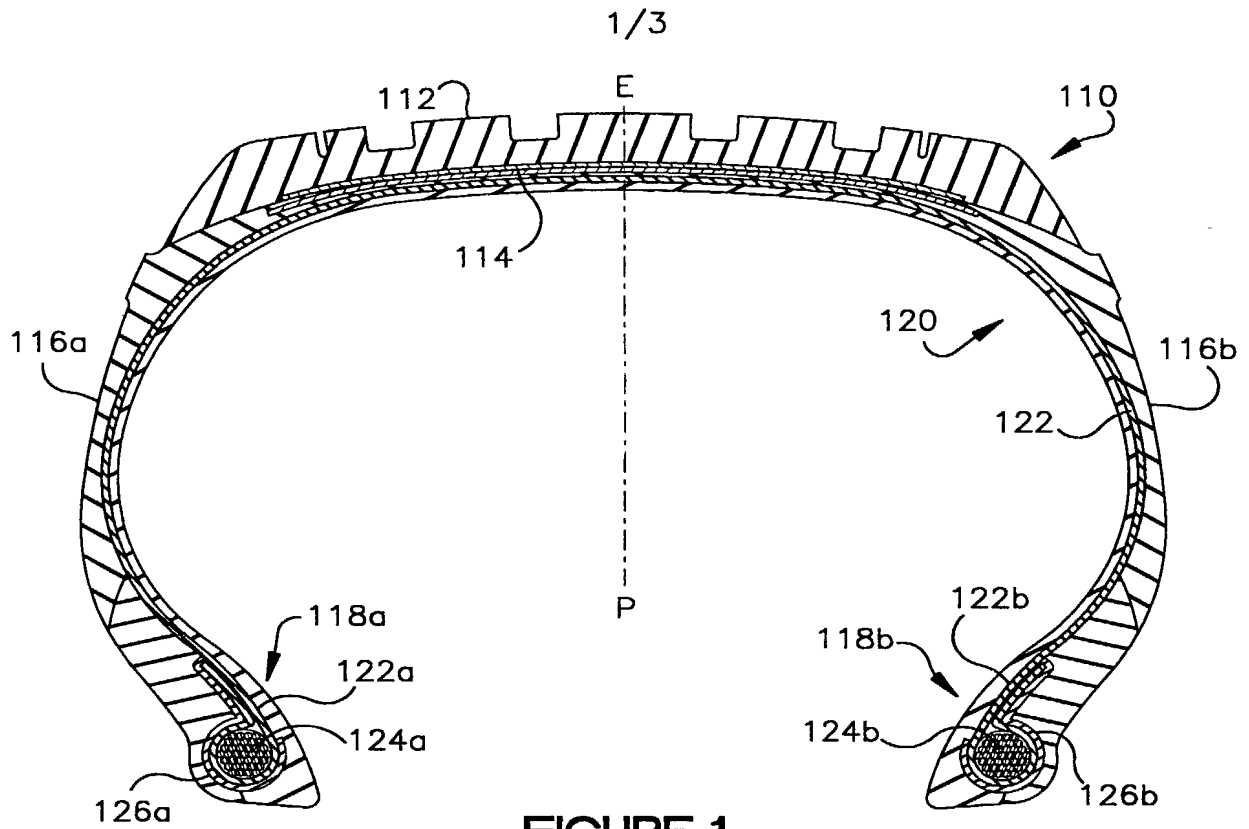
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **PNEUMATIC TYRE HAVING LOCKED BEADS**



(57) Abstract: The present invention relates to a locked bead type of tire construction where the turnup ends (242a, 242b) of the carcass plies (242) are turned up around an elastomeric torus (246a, 246b) located outwardly from and adjacent to the bead cores (244a, 244b) so that the locked end sections (250a, 250b) of the plies are folded back and placed radially inward of the bead cores so they are anchored between the bead cores and the turnup ends of the carcass plies.

WO 01/25031 A1



2/3

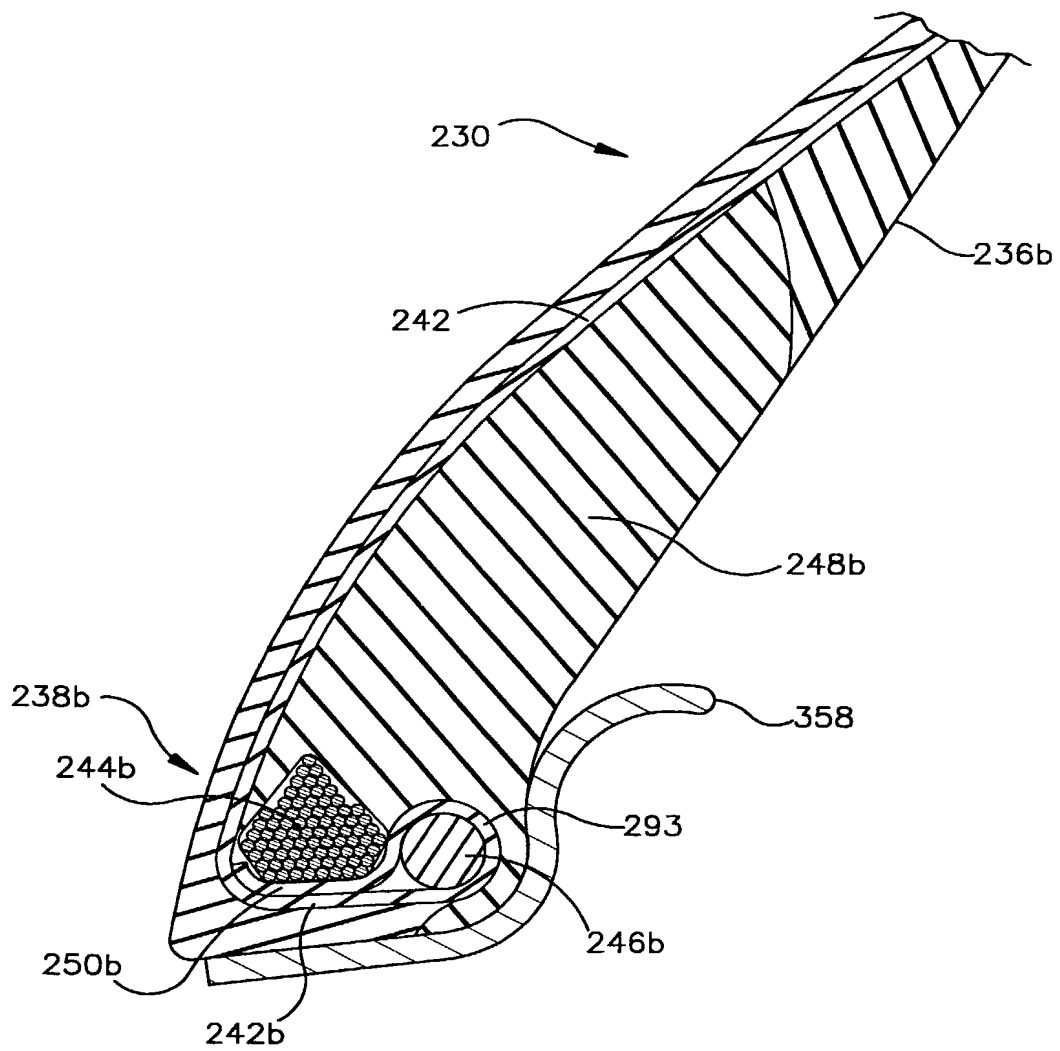
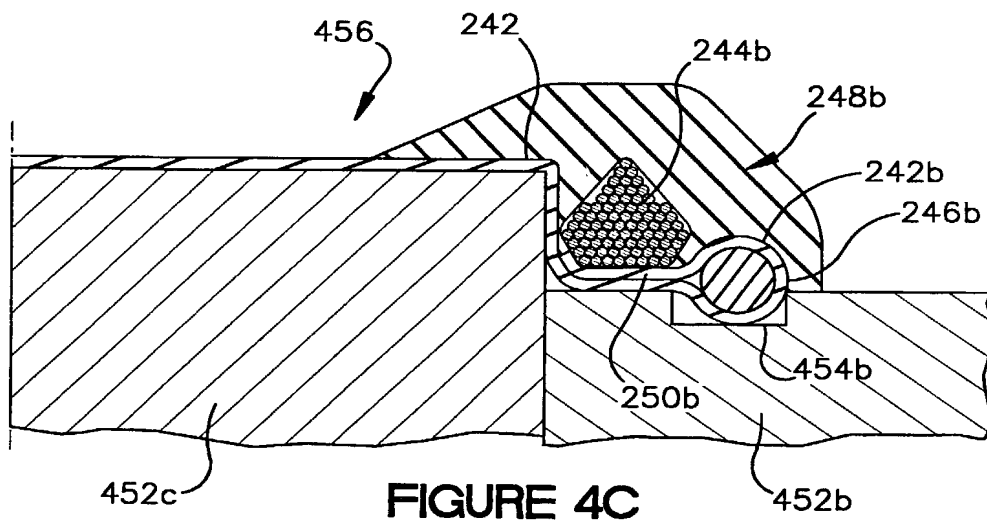
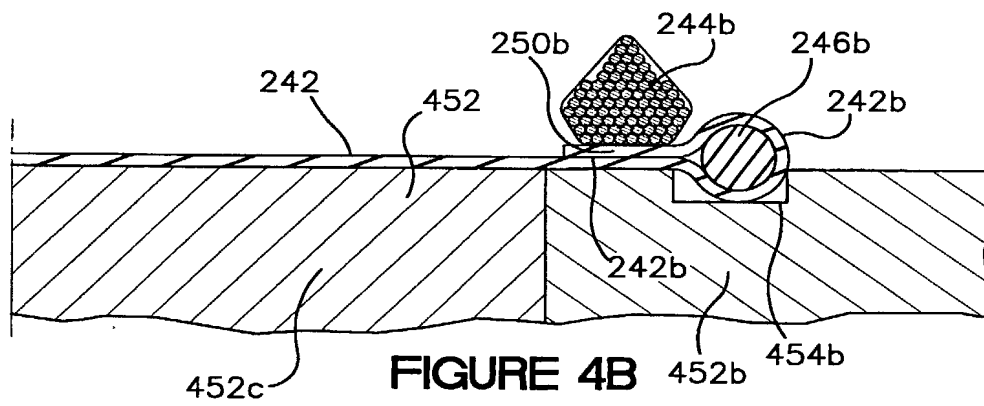
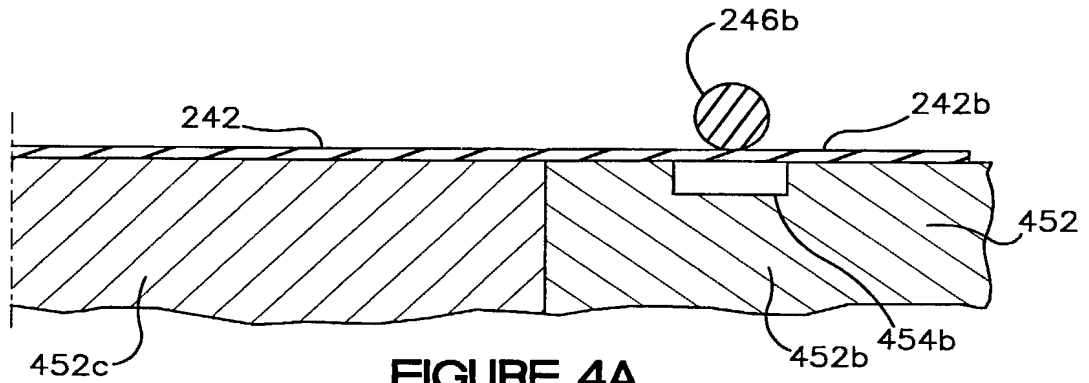


FIGURE 3

3/3



DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled LOCKED BEAD CONSTRUCTION the specification of which (check one)

_____ is attached hereto.

X was filed on September 30, 1999 as Application Serial No. PCT/US99/22568 and was amended on November 5, 2001 (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56. I hereby claim the benefit under 35 U.S.C. §119(c) of any United States provisional application(s) listed below:

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(Filing Date)

(Status)(patented, pending, abandoned)

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As named inventor(s), I or we hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

David L. King

Registration No.

33,925

David E. Wheeler

Registration No.

29,726

Howard M. Cohn

Registration No.

25,808

Nancy T. Krawczyk

Registration No.

38,744

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Full name of sole or first inventor (given name, family name) Jean-Marie Jules Joseph Koeune

Inventor's signature Jean-Marie Jules Joseph Koeune Date 4/3/2002
 Residence B-6600 Bastogne, Belgium REX Citizenship Belgium
 Post Office Address Foy, 7 B-6600 Bastogne Belgium

☐ Additional inventors are being named on separately numbered sheets attached hereto.

SEND CORRESPONDENCE TO:
 The Goodyear Tire & Rubber Company
 Patent & Trademark Department - D/823
 1144 East Market Street
 Akron, Ohio 44316-0001

DIRECT TELEPHONE CALLS TO:
 Howard M. COHN, Patent Attorney
 (216) 752-0955